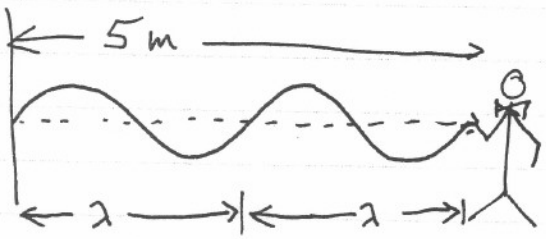
Physics 131 - Homework VIII-IX - Solutions

1. 

So $\boxed{\lambda = \frac{5\text{m}}{2} = 2.5\text{m}}$ (or, this standing wave has 4 half-wavelengths, so

$4 \cdot \frac{\lambda}{2} = \ell \Rightarrow \lambda = \frac{\ell}{2} = 2.5\text{m}$

2. We know $n \cdot \frac{\lambda}{2} = \ell$, so $\lambda = \frac{2\ell}{n}$. Also, $v = \frac{\lambda}{T}$, so, if $v = 50\,\text{m/sec}$, & $\ell = 1\text{m}$

$$f = \frac{1}{T} = \frac{v}{\lambda} = \frac{nv}{2\ell}$$

lowest 3 are $n = 1, 2, 3$, so

$$f_1 = \frac{1 \cdot 50}{2 \cdot 1\text{m}} = 25\ \text{Hz}\ (\text{osc/sec})$$

$$f_2 = 2f_1 = 50\ \text{Hz}$$

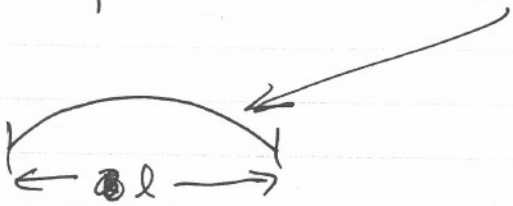
$$f_3 = 3f_1 = 75\ \text{Hz}$$

3. Two waves (sound wave & string wave) that share the same frequency, since one causes the other.

Sound wave: $\lambda = 0.25\,m$, $v = 300\,m/s$

so $f = v/\lambda = \frac{300\,m/s}{.25\,m} = \boxed{1200\,Hz}$

String wave: Lowest mode, so $\lambda = 2\ell = 2\cdot(75cm) = 1.5m$



$v = f\lambda = 1200Hz \times 1.5m$

$= 1800\,m/sec$

4. We are given the wave $A(r)\sin(2r - 600t)$ ($2 \to k$, $600 \to \omega$)

a) $v = \frac{\omega}{k} = \frac{600}{2} = \boxed{300\ m/s}$

b) ~~300 m/sec~~

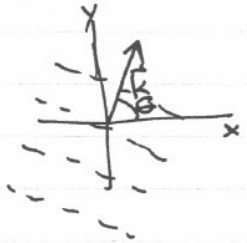
$\Delta t = \frac{d}{v} = \frac{100\ m}{300\ m/s} = \boxed{\frac{1}{3}\ sec}$

5. We are given $\sin(3x + 4y - 20t)$

This is a plane wave $\sin(\vec{k}\cdot\vec{r} - \omega t)$

where $\omega = 20$, $\vec{k} = (3,4,0) \Rightarrow |k| = \sqrt{3^2+4^2} = 5$

a) Direction of propagation is given by $\vec{k} = (3,4,0)$



Angle is given by

$\tan\theta = \frac{opp}{adj} = \frac{4}{3}$

So $\theta = \tan^{-1}\left(\frac{4}{3}\right) = \boxed{.927\ rad = 53^\circ}$

b) $v = \omega/k = 20/5 = \boxed{4}$